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West Europe Report

SCIENCE AND TECHNOLOGY

No. 60

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BIOTECHNOLOGY

BRIEFS

PROMOTION OF BIOTECHNOLOGIES--The General Delegation for Scientific and Technical Research (DGRST) has created a "biotechnologies" task force. Its mission is to support and develop basic research in the field of biotechnologies (genetic engineering, microbiology, etc) and facilitate the transfer of the results to industry, in liaison with the National Agency for Valorization of Research [ANVAR]. Inspired by Professor Pierre Douzou, this task force "borrows" from four sectors of DGRST: basic biology, transfer research (particularly transfer to agriculture and the agro-food industries), chemistry and drugs. The intervention credits placed at its disposal in 1981 amount to Fr 45 million. [Text] [Paris L'USINE NOUVELLE in French 9 Apr 81 p 59] 9828

CSO: 3102/242

BRIEFS

GOVERNMENT FUNDS FOR SOFTWARE--A series of assistance measures for new technologies in information processing is foreseen in the budget of the Federal Ministry for Research and Technology. According to statements of the Federal Research Ministry before the Committee for Research and Technology in the German Bundestag, above all manufacturers in data processing, software houses and universities should be supported. A particularly difficult bottleneck is the use of software. Innovations and utilization of computers in all sizes from microcomputers to the large computer systems are being neglected because the development of software is too costly or because of insufficient flawlessness and dependability in software. Software costs would now comprise about 80 percent of system costs. According to the research minister, producers and users need methods and tools in order to produce software cheaply and dependably. This should be state supported. Pattern recognition also belongs in the area of state support. By that is meant the processing of images as well as speech in computers. The development of computers should also be further assisted by the state. This is justified by the fact that future requirements for dependability, data security and error tolerance as well as network formation call for performance that will again result in new computer systems. The future, as Research Minister Von Buelow stressed, belongs to multiple computer systems. The German data processing industry, however, seems to be caught up in its daily business and dependable basic scientific concepts are lacking here. [Text] [Frankfurt/Main BLICK DURCH DIE WIRTSCHAFT in German 8 Apr 81 p 5] 9746

CSO: 3102/247

ENERGY

NETHERLANDS ASSESSES ALTERNATE ENERGY POSSIBILITIES

Huizen AARDE & KOSMOS in Dutch Feb 81 p 83

[Article: "Solar and Wind Energy in the Netherlands"]

> [Text] Slowly but surely the awareness is growing in our country, among official and unofficial bodies, that wind and solar energy are not completely insignificant in Western Europe either. An example of this development is the contribution which TNO [Netherlands Central Organization for Applied Natural Scientific Research] wants to make in the exploitation of the above mentioned energy sources.

On 5 and 6 November of last year, an international symposium on the storage of solar energy, organized by TNO, was held in Amsterdam. On this occasion TNO research was presented, from which it appears that solar energy also holds possibilities for the not too distant future for the Netherlands (and Belgium). This is the case when effective storage materials (such as hydrated salt, salt in which water molecules have been trapped) are used. Heat can be stored in such materials and in turn released again more slowly (for example, in the evening and at night).

Long term heat storage (for example, from summer until winter) is very important in our climate. According to TNO, heat storage in the soil, in suitable earth strata, or with the help of heat exchangers probably offers the best possibilities. Such storage systems are being tested in Sweden, France and the United States. Such a project is in preparation in the Netherlands.

Heat storage via chemical reactions may also be a possibility, even though little research has been done in this area as yet. Such a storage is based on the principle that with the absorption of heat, a certain chemical reaction produces a substance which, in turn, can be subjected to the opposite reaction; this would once again free the absorbed heat.

Among the real possibilities for using solar energy, there is also the harvesting of that energy on the basis of biological principles (for example, photosynthesis). This is the conclusion of a report issued in 1980 by the National Council for Agricultural Research TNO. The report suggests that other systems, besides solar cells, to transform incident solar light into energy are certainly worth studying. In a number of cases, these systems are even now already economically profitable for industrial purposes. Up to now, these systems have been given very little attention and, consequently, the report pleads for more research.

8463
CSO: 3102/243

ENERGY

IMPLEMENTATION OF SUBSTITUTE FUELS PROGRAM BEGINS

Paris AFP SCIENCES in French 19 Mar 81 pp 28-29

[Article: "Substitute Fuels: Status of Progress of the French Program"]

[Text] PARIS--Now about 2 months since the launching of a substitute fuels program, on 14 January of this year, a Ministry of Industry memorandum takes a look at the status of the progress of that program (see AFP SCIENCES No 245, 15 January, pp 6, 28 and 30).

Automobile test program:

Starting in 1981 a fleet of nearly 500 vehicles will be driven more than 6 million kilometers. The outlays planned for this year amount to about Fr 12 million for these tests.

Pilot plants for producing butyl acetone from vegetable matter:

a) It has been decided to begin in 1981 to set up in Soustons (Landes) a platform for development of biotechnology.

This 1-ton/day pilot plant, which represents investments of Fr 37 million, will make it possible to perfect the techniques of enzymatic hydrolysis. The plant will be able to operate on cornstalks, straw, and forage crops (and cellulose in general). Its start-up is planned for 1983.

It will serve as an experimentation tool open to the research community.

Furthermore, the experimental pilot plant for acid hydrolysis treatment of wood has just been built in Tarnos near Soustons by Bertin-ELF [French Gasoline and Lubricants Company]-Aquitaine in partnership following a course of action initiated earlier by the Delegation for Innovation and Technology, and the "fermentable juices" produced by the plant will be treated in Soustons and in various laboratories (Solaize in particular).

Thus the conditions will be assembled in Soustons to enable it to become a leading center dedicated to biotechnology, as recommended in particular in Pelissolo's report on biotechnologies.

b) A decision has been made in principle to start work in 1981 on a pilot plant for butyl acetone production from Jerusalem artichoke.

It is to be a 10-ton/day pilot plant which will go into production at the end of 1982 or beginning of 1983 and will be used to test, on a reduced scale, the feasibility of building an industrial installation.

The site for this pilot plant is still not settled, but it ought to be situated in a region favorable for growing Jerusalem artichokes and on a site as favorable as possible to minimize the investment costs, which, in any event, will be on the order of Fr 50 million. The experts' analyses of this plan are still in progress, and a decision could be reached following these analyses.

Three other installations are under study:

1. an experimental platform for the study of gasification of coal and heavy petroleum residuums;
2. a heavy methanol pilot plant; and
3. a pilot plant for gasification of wood using oxygen.

Plan for Implementation of the Pilot Plants

A unique plan bringing together all the underwriting parties will be implemented for the pilot plants using vegetable matter, which will be under the aegis of and be operated by the French Petroleum Institute.

The French Petroleum Institute, COMES [Solar Energy Commission], the French National Petroleum Companies, the agricultural community, and the local authorities concerned will provide appropriate financial contributions.

Concerning the other pilot plants (heavy methanol, gasification with oxygen), modified installations with participation of the concerned industries will be established.

Feasibility of Producing Methanol from Lorraine Coal Is Under Study

For this idea, the first order of business is to obtain assurance of the competitiveness of such industrial investments (nearly Fr 1.5 billion in investments for an annual production of 500,000 tons).

This study will be completed in the course of the next few months and in particular will assess the changes in world energy prices.

Contacts have been established with West Germany, Norway, Sweden, Brazil, and Mexico to deepen relations and perhaps move on toward purchases of products in the domain of substitute fuels.

In total, the outlays committed under this program in 1981 will represent between Fr 150 and 200 million.

9828
CSO: 3102/236

ENERGY

FUNDING DECISIONS TO BE MADE CONCERNING COAL CONVERSION

Frankfurt/Main FRANKFURTER ZEITUNG in German 10 Apr 81 p 7

[Text] In response to an inquiry by Ludwig Gerstein (CDU/CSU delegate), the Federal Government has indicated its position regarding state expenditures for large-scale coal conversion plants. Accordingly, DM 25 million in direct subsidies and DM 795 million as a commitment authorization are foreseen in the area of the federal economics minister for the years 1982 through 1984. In the middle-term financial planning of the Research Ministry DM 153.8 million are planned for use in 1981 for coal conversion, with about DM 351 million provided for the years 1982 through 1984. As for actual coal conversion projects, the Federal Government refers to its coal conversion program of 30 January 1980. In accordance with that the Federal Government will decide about state assistance, especially in the required investments on the basis of fundamental planning work concerning location, technical layout, timing, costs and efficiency of the individual projects. Now that such pilot projects have been presented by the industry for six coal gasification proposals, the Federal Government is now preparing a decision to initially support coal gasification, which will be discussed and decided upon by the federal cabinet during spring 1981.

A corresponding decision in the area of coal liquefaction is expected for the second half of 1981. Industry project proposals for coal conversion with an annual coal usage of 6 million tons exist only in the area of liquefaction, namely from Ruhrkohle and Veba-Oel-AG. On this score pilot projects are expected in the next few months. According to interim reports by the enterprises, the investment costs for such a plant could be between DM 6 and 8 billion. Here one should take into account that the companies want to build the plants using a modular system, so that initially only the first module with an annual coal usage of 1.5 million tons would be built. Statements about volume and nature of state assistance are, according to the Federal Government, only possible when the pilot projects, and especially in profitability calculations, have been individually evaluated and examined. Considering the cited financial costs of such a large plant with 6 million tons of coal usage (maximum of 4 million tons of oil derivatives), and with the present oil price of about DM 600 per ton, a large government subsidy is necessary just to make possible the construction of such plants. That allows a rough estimate when one considers that just for the 6 million tons of coal at least DM 1.3 billion must be expended annually in raw material costs. Added to that are write-offs and high operating and capital costs, so that at the present price of oil the annual subsidy requirement will be in the area of DM 1 to 2 billion.

9746
CSO: 3102/247

ENERGY

BRIEFS

METHANE FROM MANURE--/The Biogaz unit in Saint-Symphorien (Sarthe), for example, can produce 400 cubic meters of gas per day/ [in boldface]--The production of methane from animal refuse is one of the most directly applicable uses of biomass, meaning the totality of plant resources capable of producing energy. There are several million small digesters installed on farms in China and a few tens of thousands in India. It is estimated that in 1976 the methanization of animal excrement worldwide produced 63 million tons oil equivalent. If all the animal manure in France were utilized, it would be possible to produce 4 billion cubic meters of gas--or 2 million tons oil equivalent, pointed out Henry Durand, president of COMES [Solar Energy Commission], in dedicating the Biogaz unit in Saint-Symphorien (Sarthe), one of the largest in Europe. This installation was built jointly by the French Mining and Industrial Enterprise, the Sanders company, the commercial French Potash and Nitrogen Company, and PEC [French Potash and Chemical Fertilizers Company] engineering. The budget is more than Fr 5 million, in which the COMES participation is Fr 600,000. The system utilized for producing methane from manure is a 250-cubic-meter digester made of prefabricated concrete, producing 400 cubic meters of gas per day, feeding a boiler or a generating set taking care of a third of the Electrical Energy Center's needs. The Solar Energy Commission, in cooperation with industries, will launch a feasibility study concerning mass production of individual digesters capable of handling the energy needs of an average farmholding. The market for this type of apparatus in France is well in excess of 10,000 units--provided they do not cost more than Fr 8,000 per ton of petroleum saved. For such a case, the investment could be amortized within 6 years. [Text] [Paris LE MATIN in French 7 Apr 81 p 22] 9828

CSO: 3102/236

INDUSTRIAL TECHNOLOGY

GERMANS ACTIVE IN DEVELOPING NEW-GENERATION SENSOR ROBOTS

Duesseldorf WIRTSCHAFTSWOCHE in German 3 Apr 81 pp 104-106

> [Text] The Hannover Fair represents a high point for German robot technology: The firm Kuka is exhibiting the first German manipulating automats with production sensor equipment. Robots with "human" capabilities have moved beyond the research laboratories.

In exhibit hall 5 at the Hannover Fair is located the sensor-equipped Kuka 601/60 CP--a world first. The industrial robot, a monster of iron and stainless steel with a long neck and grippers not unlike those of an oversized bird of prey, works without ceasing.

His neck extends when a pallet of steel bottles approaches. He selects one, turns on his axis and places the bottle on a passing conveyor. The bottle does not fall over because Kuka has programed the direction and speed of the conveyor into the robot. He grasps the bottle from the moving conveyor, turns and lays it at an angle in a storage rack. Then he returns to the starting point, picks up the next steel bottle and repeats the process.

The managers of Kuka Welding Equipment and Robots GmbH feel confident that the Kuka 601/60 with these capabilities guarantees German robot technology a place at the top in world performance, especially since it incorporates what is called path guidance. This is different from conventional point-to-point control. The robot does not just proceed to each programed point in space with the sureness of a sleepwalker: During production it can branch into a subprogram and repeatedly retrace a path between two points with millimeter accuracy.

A robot of this kind does more than routine spot-welding jobs. It is well qualified even for tedious assembly operations.

But the Kuka robot is capable of even more: It can feel and react. The monster's control system has two sensing interfaces; that is, the robot is equipped in such a way that a signal transmitted from a sensor to a stored program results in an alternative motion. The manipulating automat being exhibited by Kuka, which will be ready for delivery after about next spring at a price of just under DM 300,000, has grippers equipped with a capacitive "thinking" sensor.

via electric current, the robot recognizes whether his grippers are properly bearing on and gripping the steel bottles. In case of deviations, the signals are converted directly into correction instructions for the robot's arm. "We have no competition in the European market with regard to this device," relates enthusiastically Stefan Mueller, Kuka's director of promotions for manipulating automats. Only the American manufacturer Cincinatti Milacron, Inc. offers a robot with similar features in this size.

The first production-mature models of an expensive, intelligent robot generation which do more than just simple, repetitious operations have left the research laboratories and have appeared on the market. For Kuka the new sensor-controlled automat provides not just a leap ahead of the competition. It opens for the company, which until now has sold its working machines exclusively to the automobile industry for spot-welding tasks, the opportunity to win new customers in other industries for new applications, such as grinding, cleaning castings and assembly.

Of course, the Augsburg firm must share the pride of accomplishment in their new product with others since they do not produce the path guidance and sensor units themselves. The sensor is supplied by the Fraunhofer Institute in Karlsruhe, and the path guidance system is from the Munich firm Siemens AG, Germany's largest electrotechnical concern. Kuka has to be concerned that Siemens soon will no longer just be on the list of suppliers but will also be on the list of competitors.

Actually, the Munich firm could already be among the large German suppliers in this field. They made an early start but shelved their development effort at the beginning of the 1970's because the potential applications were for in-house operations and Siemens managers feared this would lead to problems and conflicts with the work force and labor council. Today the Munich firm rues that decision; however, they intend to make up the lost time with help from the Japanese.

Already in 1978 the Munich firm had signed a cooperative agreement with the Japanese electronic giant Fujitsu Ltd., which Siemens helped to establish and in which Siemens is still a minority shareholder. Today, Siemens buys large computers and other equipment from Japan and sells them here under the Siemens label. The Fujitsu subsidiary, Fujitsu Fanuc Ltd., is among Japan's leading robot manufacturers.

Siemens is already getting small numbers of robots from Fanuc which are sold here under the name "Sirobot." Siemens and Fanuc have agreed that after about 1985 both together will offer a new generation of sensor-controlled robots especially suited for assembly work. These could be a threat to the Kuka robots.

Siemens and Fanuc have already divided up the tasks and markets for this project. It is still unclear whether or not Fanuc will do all of the assembly work. It is clear that both will equip their robots with their own, independently-developed control systems.

Fanuc will supply Asia; Siemens, Europe; and the two will share the United States, according to application categories. Siemens has now received the task of providing sensors for the total program.

For Siemens this is surely no great problem. The firm has years of experience in sensor technology, albeit not directly in the field of manipulating automats. In the two systems Videomat and Opto-Korrelog Siemens possesses optical recognition equipment which is being further developed into high-performance optical sensor systems for their robots. Today, Siemens uses Videomat for recognizing and sorting out damaged piece parts in widely varied areas of the company. And Opto-Korrelog--both systems employ TV cameras--was developed for positioning semiconductors and other uses.

Siemens already offers sensors for color recognition. A demonstration device equipped with this system, which sorts buttons by color, is being shown at the Hannover Fair. Dr Ing Rudolf Hell GmbH, a Siemens subsidiary in Kiel, already offers printing and textile machines equipped with this sensor. The sensor reads a master pattern and converts the color impulses into a pattern for looms, which then weave exact copies of the master. From the standpoint of technology, nothing stands in the way of combining this sensor with manipulating automats.

Of course, Siemens is not the only firm in Germany which offers sensors. Brown, Boveri and Cie in Mannheim has in the meantime developed to production maturity its OMS (Optoelectronic Measuring and Sensing System) which was introduced 2 years ago at the Hannover Fair as a prototype optical sensor system. The Mannheim firm has already successfully combined it with the small Puma robot of the U.S. manufacturer Unimation Inc.

As in the case of all systems which can be considered as market ready, cost is a problem. The OMS system costs just under DM 100,000, about as much as the robot itself. BBC is attempting, of course, to enter the business with robot manufacturers and users through the back door. At the Hannover Fair BBC presented an optoelectronic positioning device under the name Opos, which works in combination with the OMS. In all cases where nonaligned parts must be aligned for feeder mechanisms or blind robots, Opos puts the part in a position from which, for example, it can easily be picked up and carried away by a blind robot.

Robert Bosch GmbH is still attempting to get aboard the robot train. This Stuttgart firm has developed a robot kit from which manipulating automats can be assembled for a variety of applications. Bosch offers, for instance, a three-axis robot for small-scale production. "We believe," relates Gerhard Widl, member of management in the Industrial Equipment Department at Bosch, "we are able to offer more economical problem solutions with such a system than with standard universal robots."

And also in the area of sensors, Bosch has something to offer. The Stuttgart firm sells an optical system developed by the Fraunhofer Institute in Karlsruhe which is displayed in combination with Unimation's Puma robot at the Hannover Fair at the stand of the Fraunhofer Institute for Production Engineering and Automation, Stuttgart. Even yet, Kuka views the mounting competition with the electrical concerns with composure. The Augsburg firm is working diligently on the development of medium-sized robots which are intended for assembly work. Moreover, they have in the meantime solidly established themselves as robot suppliers in one of the most important branches of application, the automobile industry. Only recently they received a new large contract from their main customer, Daimler-Benz, which ordered 41 Kuka manipulating automats for DM 10 million. The colossuses will weld together the bodies of the new small Mercedes models.

9160
CSO: 3102/249

INDUSTRIAL TECHNOLOGY

ASSEMBLY ROBOTS: NEXT STEP IN INDUSTRIAL AUTOMATION

Paris LE MONDE in French 21 Apr 81 pp 7, 9

[Article by Richard Clavaud: "New Sectors Opening Up to Robotics"]

[Excerpts] If France's robotics industry wants to play a part on the European and perhaps worldwide level, it must develop in sectors neglected up to now by large-scale manufacturers who are interested primarily in products that they can incorporate in their own production. A BIPE (Economic Information and Forecasting Bureau) report studies an especially promising field: automatic assembly.

Assistance Policy

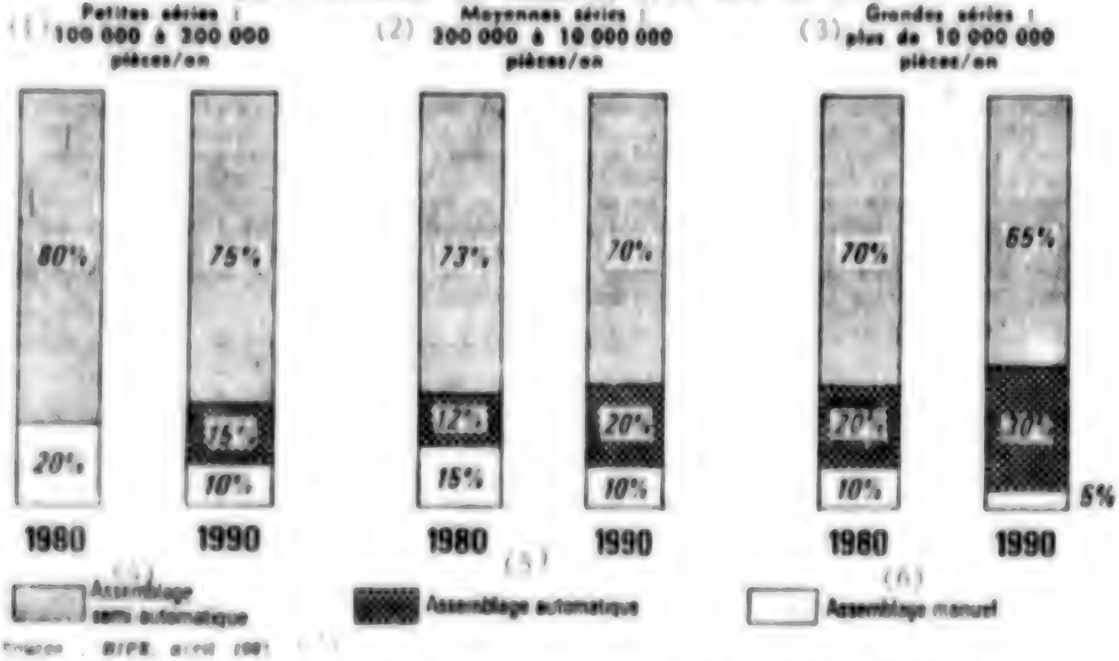
The price of equipment, ranging between 25,000 and 50,000 francs, is a restraint on the development of robotics. This situation has led the Ministry of Industry to set up assistance procedures for companies equipping themselves with automatic machines. The assistance policy started in 1974 with the MOCN (Numerical-controlled Machine Tools) procedure, which became the MECA [Advanced Design Machines and Equipment] procedure, in 1980, enabling small-sized and medium-sized industries (PMI) to benefit from discounted loans to buy a numerical-controlled machine tool. This effort found expression in the installation of 500 MOCN in companies employing less than 1,000 persons on the basis of a "satisfaction or money back" agreement. A company agreeing to try an MOCN can return it to its supplier within 2 years following its installation, if it is not satisfied with it. The supplier is compensated by a guarantee fund. The excess cost of the automatic machine in comparison with an item of traditional equipment is assumed by the state. This procedure has produced good results. Only two or three machines have been returned to their supplier since 1974 and the introduction of a first machine often results in further purchases by companies. In view of this success, the MECA procedure, administered by ADEPA (Association for the Development of Automated Production) was extended recently to new categories of automatic machines, especially for the agricultural-food industry and the textile industry and it might soon be applied to plastics processing, handling, graphic arts, and so on.

Large companies (over 1,000 employees) have not been forgotten. They benefit from CODIS (Committee for the Development of Strategic Industries) aid, one of whose priority subjects is automation of manufacturing industries by means of robotization. The aid finds expression in discounted loans for pilot operations using industrial robotics (flexible shops).

Although somewhat late, this mobilization should assist French industries in revising their conceptions on production methods, just like what has been done for long time now abroad, in Japan, in the United States, but also in Europe, in Sweden, in Germany and in Italy. It should also make it possible to develop the production of components used in the manufacture of automatic machines (motors, sensors) for which France is still considerably dependent on foreign countries. With regard to the electrical part of automatic devices, its mastery rests on the future of the "components plan."

At a time when French industrialists are still wondering about the pace to be followed for automating production, a new generation of machines is making its appearance in research laboratories: assembly robots. According to a report that the BIPE has just forwarded to CODIS, automatic assembly systems will be industrialized around 1985 and will mark a great leap forward in robotics. The leading sectors involved are machine-building, electrical, electronics and the whole automobile industry. Automatic assembly is already used in some sectors for mass production. It has enabled some companies to secure a leading place for themselves on certain markets: Bosch for sparkplugs, Timex for watches, BIC for cigarette lighters and disposable razors. Owing to the development of flexible production systems, automatic assembly is now of interest to medium-scale and small-scale production lines.

Distribution of Automated Assembly Equipment
(all Sectors) in France, from Now to 1990



Source : BIPE, avril 1981 (7)

Key: 1. small-scale production: 100,000 to 200,000 items a year; 2. medium-scale production: 200,000 to 10,000,000 items a year; 3. mass production: more than 10,000,000 items a year; 4. semiautomatic assembly; 5. automatic assembly; 6. manual assembly; 7. Source: Bureau of Economic Information and Forecasting, April 1981.

On the European level, Germany with Bosch and Italy with DEA and Olivetti have already taken somewhat of a lead in this field in the manufacture of those types of equipment. A version of Olivetti's Sigma robot makes it possible to assemble engine parts (piston, connecting rod, axle), electrical equipment (condensers, sockets or typewriter keyboards). For small components, the feed for these robots is handled by vibrating wooden arms that position the parts to be assembled. Pragma, the robot developed by DEA, has interested the Americans very much, so much so that General Electric has just acquired the license for it. In France, some companies are moving in the direction of automatic assembly. It is especially a question of SEIV (Renault group), the Electromechanical Company, the Telemechanical Company and Leroy-Somer through their common subsidiary AFMA. Another company little talked about at present might soon appear as one of the leaders in the sector, SORMEL, a YEMA subsidiary (MATRA [Aeronautical Equipment and Production] group). It has developed small manipulators and assembly robots. Automation of this sector depends on the development of advanced technologies, especially sight sensors (cameras) and pressure sensors (artificial skin).

The BIPE mentions the example of the United States the only country where sector statistics have been drawn up and notes that assembly work uses 30.2 percent of the personnel employed in the agricultural machinery sector and 33.5 percent in the automobile construction sector. The cost of this labor force represents, respectively, 7 percent and 4 percent of the final cost of the product, a relatively low percentage, but one that amounts in value to considerable sums. In France, assembly tasks employ 550,000 persons at present. If 10 percent of those jobs are automated between 1985 and 1990 and if the cost not to be exceeded for an automatic assembly system is fixed at 200,000 francs, the market will reach 11 billion francs a year. It will probably go from 150 million francs at present to 2 or 3 billion francs around 1990. A figure that should be compared with the machine-tool market representing 4 billion francs a year.

The BIPE forecasts are much more optimistic than certain market studies, which, it is true, attach less importance to the development of automatic assembly. The Frost and Sullivan market study company predicts that the number of industrial robots installed in Europe should increase from 2,400 at present to almost 20,000 in 1990. With regard to France, the AFRI (French Industrial Robotics Association), referring to a AEC [Atomic Energy Commission] study, indicates that the national robot market should reach 250 units by 1985. This association estimates that, at present, the world market is worth $60 million and that it will increase to $1 billion in 1985. The development of the market is encouraging some groups to give preference to the development of robotics to the detriment of activities being affected at present by a crisis, like the automobile industry. The BIPE report also studies the developments that automatic packaging will take, stimulated by the growth of the agricultural-food industry and of large-scale distribution methods.

The number of market studies and professional meetings on the development of robotics contrasts with the silence observed concerning the social consequences of the introduction of these new technologies. Although most of the observers and persons with economic or social responsibilities, including labor unions, realize the need for automating, in order to meet international competition, opinions differ with regard to the utilization of the additional profits that this effort will make it possible to obtain. The labor unions believe that it would be necessary to limit the workweek to 35 hours. Company officials seem to be more interested in the relaxation of laws on shift working, which has a tendency to become generalized when automation is installed.

In order to have the changes in progress and their consequences accepted, most company officials have become aware of the need for starting a dialogue. Discussion about the "advantages" of automation (elimination of hard work, enhancement of tasks) is accompanied by a search for speakers capable of accepting a "consensus." First of all, it is a question of a "modernist " fringe of the worker world, carefully selected and deliberately favored at the time of transfers from eliminated jobs to new ones. Employers also turn toward personnel to whom the government has just promised measures favoring employment of the jobless. In its press conference on 24 March this year, the CNPF [National Council of French Employers] admitted for the personnel staff "a preferential role of encouragement and coordination," in order to introduce "the permanent dialogue." A dialogue without labor unions removes all realism from the project. "(The labor unions) are there to perform certain tasks," Francois Perigot, chairman of the social reports committee of the CNPF stated, "but the permanent dialogue that we are talking about is not one of those tasks. This dialogue must be made with the members of the company without any intermediary."

Once more, the risk is run of witnessing a dialogue on different wavelengths.

List of Companies and Associations Mentioned

ADETIEF: 8 Pierre-Legrand Street, Paris 75008; telephone: 766-9296.

ADEPA: 17 Perier Street, Montrouge 92120; telephone: 657-1270.

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INDUSTRIAL TECHNOLOGY

H. ERNAULT-SOMUA TURNS TO AUTOMATION TO MEET COMPETITION

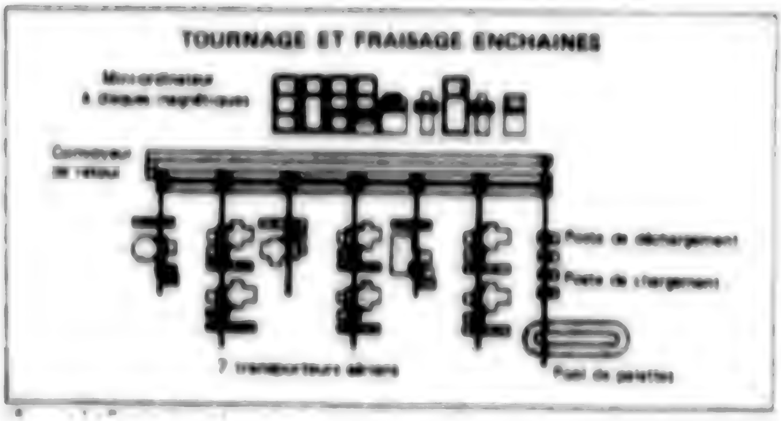
Paris INDUSTRIES & TECHNIQUES in French 1 Mar 81 pp 14-15

[Article by Andre Larane]

[Text] An antiquated image, overwhelming foreign competition: These are the challenges to be overcome by H. Ernault-Somua. To cope, the machine tool builder has decided on a drastic reconversion: the bringing out of a line of digital-controlled production lathes, the perfection of a modular machine, and the development of flexible workshops.

In what amounts to a radical restructuring, H. Ernault-Somua will now concentrate on digital-controlled lathes and, above all, will go all out in the field of assembly of flexible workshops. With respect to milling and cutting tools and machining centers, in the HES-Toyoda subsidiary, it will rely upon the experience of the Japanese. The counterpart is painful: It is the closing down of the Lisieux plant (250 persons), which was decided officially on 31 December. One of its product lines, turret lathes, has been abandoned. The Cholet plant is being devoted to the future line of direct digital-controlled, inclined bed lathes, the prototypes of which were exhibited at Chicago in 1980. The Moulins plant has been assigned to flexible workshop assemblies and to the TC 100 modular lathe.

How will it face up to the need for increased production with a reduced staff? There is only one possible solution: automation. At Moulins, two flexible workshops are in the process of being built. Well-ordered charity begins at home: The two workshops will be fitted out with machining centers and TC 100 lathes. The first of these workshops will fabricate all the prismatic components of the modular lathes; the second, all the turned parts. Together, they will reduce current production costs by a modest 6-8 percent. But over a period of several years, the overall advantage will prove substantial, in that, amortization, unlike wages and salaries, will remain stable. Furthermore, the elimination of inter-operations delays will reduce production time losses to virtually nil. The fabrication today of boring machines requires from 9 to 14 weeks. The flexible workshop will reduce to a few hours the time involved from the start of programing of the fabrication of a unit to receipt of the finished product. Mr Albrecht, president and general manager of the company, is zealously supervising the project. He has opted for a decentralized network equipped with minicomputers in parallel,



Key:

1. Coupled Turning and Milling
2. Magnetic disk minicomputer.
3. Return conveyor.
4. 7 overhead transports.
5. Pallet pool.
6. Loading station.
7. Unloading station.

By year-end this year, flexible lathe and machining center subassemblies with decentralized softwares will be operational at H. Ernault-Somua. Elimination of inter-operation transit and storage times will reduce the production time of a machined piece from several days to a few hours.

which accounts for the company's cooperation with R2E [expansion unknown] in regard to the development of this type of electronics. As compared with a centralized direct digital-controlled system, the decentralized system is more reliable. The tools all work simultaneously, in accordance with their respective programs. If one of them goes into trouble, it is only necessary to shift functions around to maintain overall continuity of operations. Two of the turning workshop's modular machines will be exhibited at the Hanover fair. Three prototype lathes, which have already been sold, are operating on an experimental basis. They can carry out from 2 to 8 routines and can accommodate small boring or milling heads.

The rear of the machines is fitted for the placement of future feed-robots. The manufacturer is seeking to develop the marketing of automated work transfer lines based on the same modular elements as those in use at his Moulins plant. While he specializes in the building of lathes, where his experience is adequate, he is working together with the Japanese in the milling sector. This is the intent of the agreement signed with Toyoda, effective 1 January. The Velizy firm will bring its milling department and its Montzeron (Cote d'Or) plant into the new HES-Toyoda Company. This Franco-Japanese subsidiary will build, under license, a number of Toyoda 7.5-kw and 15-kw machining centers, as well as HES's digital-controlled milling machines and its vertical machining centers. The first six of Toyoda's 500 cubic meter machining centers are already being assembled. At normal cruising speed, the production unit will link together 20 machining centers at a time. It is expected that some 50 new jobs will be created within 2 years and added to the present milling department's staff of 287 persons. Research and development are not being neglected. We can rely on the Japanese: Specialists as they are in flexible workshops and machining centers, they will bring new blood into a particularly weak sector of the French machine-tool industry.

H. Ernault-Somua will continue marketing the products of HES-Toyoda and its own, through its recently created HES Europe subsidiary, and through the AFMO [French Machine Tool Builders Association]. It is to be hoped that its post-sales service will receive the same renovation as its production units and its products. Mr Albrecht is confident: "When all is accomplished, before the end of this year, in the area of lathe-turning and milling we will be the top-ranking in Europe, and capable of installing 20-machine work transfer lines."

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INDUSTRIAL TECHNOLOGY

SAAB'S AUTOMATED ASSEMBLY LINE DESCRIBED

Paris INDUSTRIES & TECHNIQUES in French 1 Mar 81 p 38

[Text] How can one produce 80,000 automobiles a year using just two plant shifts?

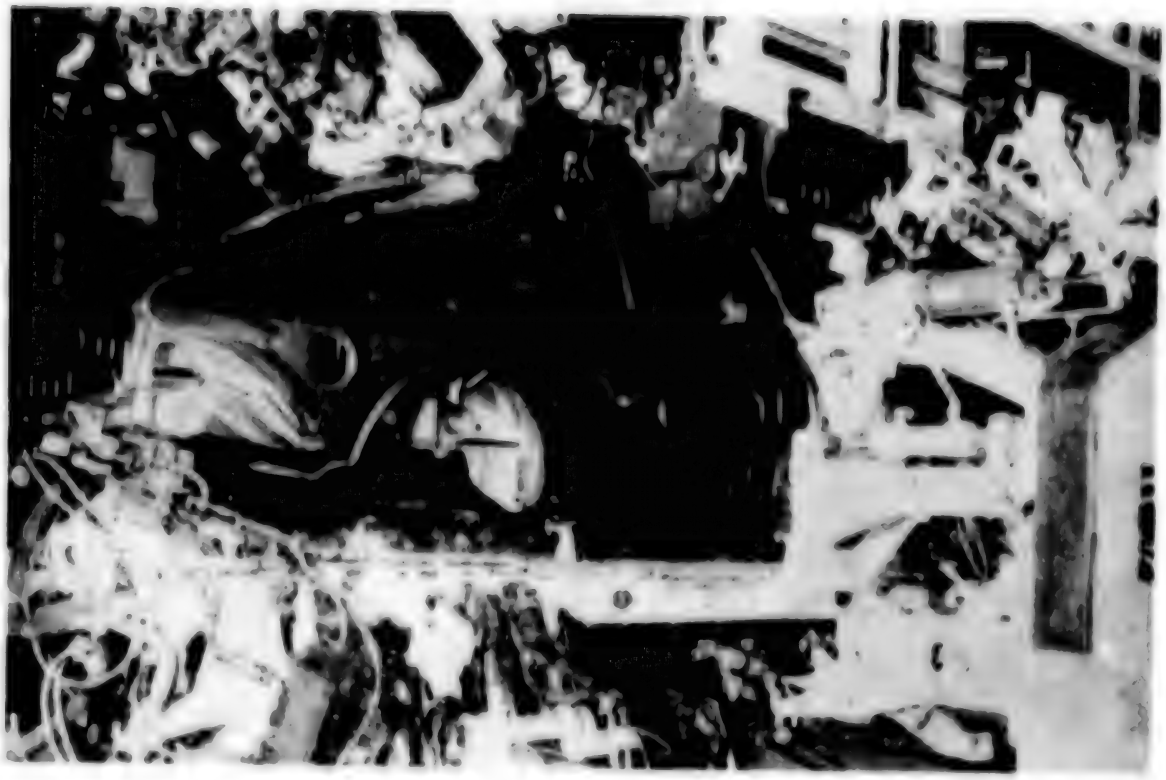
For the management of the Swedish firm SAAB (Trollhattan Suede), the answer was clear: Automate to the maximum the production lines, using the most recent equipment, especially for the assembly and spot welding operations on the body of the SAAB 900 (the top-of-the-line model made in several versions: GL, GLE, EMS, and Turbo) and its subassemblies.

The total automation of the hood production line, of the flooring production line, and of the general body assembly and finishing line has eliminated all of the toilsome work stations, resolved some labor problems, and improved the reliability and workmanship of the assemblages. Sciaky, working together with the company's plant engineers, designed and installed most of the equipment.

At the final assembly stage, for example, the completion of the bodies involves 437 spot welds on the 5-door model and 413 on the 3-door model, at a production rate of 32 bodies an hour. The welds are effected by seven ASEA [Swedish General Electric Company] robots and four Sciaky programable mechanized routines working on both sides of the line.

These programable routines are made up of motorized, multiposition, single- or dual-routine (one for displacement of the welding head or heads along the work, and one for their eventual engagement) carriages. These unmonitored, low-cost, easily programable facilities replace robots advantageously wherever their accuracy is sufficient to effect a line of spot welds.

The first station is equipped with two 6-routine robots which complete the door framings of the side panels. At the second station, two other 6-routine robots perform the final assembly welds between the dome and the side panels, while two programable mechanized routines effect the final assembly welds between the flooring and the side panels. Lastly, two robots effect the necessary finishing welds. Not a single manual operation is involved throughout this part of the body production line. It is entirely isolated from the rest of the shop by soundproof partitions and glass doors, and only the equipment maintenance personnel is allowed to enter.



Final assembly of "blank bodies" is piloted by calculators. The system indicates when preventive maintenance interventions are needed, thus avoiding production stoppages.

In the immediate vicinity of the line, a teleprinter--or a cathode-ray display console--is used for assisted maintenance operations, close to the site of intervention. In case of a malfunction, a message is immediately composed in plain language and the maintenance technician can trouble-shoot the installation. This greatly facilitates the trouble-finding process and enables the carrying out of in-service preventive maintenance interventions that avoid production stoppages.

The sequencing of the cycle of a machine or the adjustment of the welding parameters can also be modified from the teleprinter or console position. The welding process control and monitoring system completely controls each welding line as well as that of the intermediate stock points and the conveyors.

It pilots all the functions: triggering of the thyristors, timing of the welding cycle, sequential control of all movements, squeezing of the welding jacks, movements of tools and bars, transfer and positioning of the programable-displacement mechanized elements (robots).

Another advantage, and not the least by far, is the fact that the destructive tests that are traditionally performed during the construction of automobiles have been reduced to a minimum, thanks to this minicalculator.

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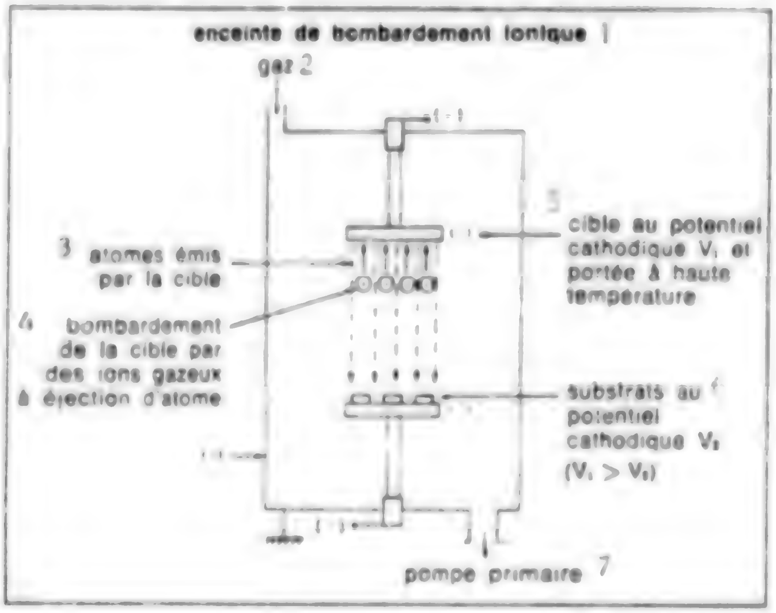
NEW 'CATHODE SPUTTERING' METAL COATING PROCESS IN USE

Paris L'USINE NOUVELLE in French 9 Apr 81 pp 97-99

[Article by Pierre Laperrousaz: "From the Decoration of Plastics and to the Improvement of Mechanical Parts"]

> [Text] Nonpolluting and less costly in investments than electroplating, cathode sputtering finds its primary applications in the decoration of plastics. It also competes with vapor coating in mirror manufacture. In mechanical uses, the applications in the area of wear and abrasion, well proven in the laboratory, are still waiting in the wings.

Those who predicted a brilliant future for cathode sputtering a few years ago have some reasons today perhaps not to celebrate but to at least be satisfied: cathode sputtering is at last beginning to be used on the industrial level. Its primary applications, as could have been expected in view of foreign experience, are in the decoration of plastic parts, where it competes with vacuum evaporation and electroplating.


enceinte de bombardement ionique 1
gaz 2
(-)
5
cible au potentiel cathodique V_1 et portée à haute température
3 atomes émis par la cible
4 bombardement de la cible par des ions gazeux à éjection d'atome
substrats au 6 potentiel cathodique V_2 $(V_1 > V_2)$
(+)
(-)
pompe primaire 7

Key:

(1) Ion bombardment chamber
(2) Gas
(3) Atoms emitted by target
(4) Bombardment of the target with gaseous ions to eject atoms
(5) Target at cathodic potential V_1 and brought to high temperature
(6) Substrates at cathodic potential V_2 $(V_1 > V_2)$
(7) Primary pump

At the end of last year Seima, in Sens, began operating a sputtering chamber which was used to treat several test series of automobile parts. More recently, Renault has been equipped with a Japanese unit from Takematsu. The supplier, Farkas Engineering, is counting on two other orders for subcontracting. In another area, optics, Hirtz Glassworks in Sarrewarden (lower Rhine) just recently began operating a Balzers machine for coating rearview mirrors.

Cathode sputtering thus is capturing the limelight among the physical methods of vacuum deposition. Evaporation, much longer in use, is directly threatened, and ion plating is being left behind. Not entirely, though, seeing that a French subcontractor specializing in coating of parts for aeronautic applications (Blanc-Aero) has just received a machine for ion plating with aluminum according to the Ivadizer process of McDonnell-Douglas. This is a first for Europe. The installation will treat titanium bolts semicontinuously in bulk. Such bolts were previously plated with cadmium by evaporation. The treatment is primarily to confer corrosion resistance.

Paradoxically, this industrial penetration of physical deposition does not correspond at all to what is being done in the laboratories and research centers in France. The latter, including the Laboratory for Study of Thin Materials [LEMM] of Grenoble, Hydromechanics and Abrasion [HEF] in Saint-Etienne, the Laboratory for Metallurgical Engineering of Nancy, and the Creusot-Loire Research Center in Ondaine as a matter of fact are essentially working on deposits for mechanical uses, very thick deposits (on the order of 5-10 microns). In contrast, the decorative layers are but a few hundred angstroms thick. This disparity is easily explained: the "mechanical" coatings involve the use of alloys or composites of more complex formulation, and there are very high requirements as to quality (friction, hardness, adherence). So their development to the industrial stage requires substantial know-how.

This does not mean however that perfecting decorative coatings does not require a long time or heavy costs. "Everything began 3 years ago, on returning from a trip to Japan," recalls Rene Lecref, technical director at Seima. "We then modified an old evaporation unit. But if it had been necessary to invest in a new machine, that would have cost us at least Fr 10 million, including varnishing." The principal modification was to replace the thermal evaporation source with two Planar-Magnetron units from Balzers. That turned out to be the simplest part. The performance of a sputtered decorative coating in fact depends heavily on the varnish which ensures its bonding to the substrate and the varnish which protects its surface.

A War-Horse: Chrome and Nickel-Chrome on ABS

The varnishing aspect is an important piece of know-how. "Numerous varnishes from Japanese or European sources have been tested," says Marc Brassier, spokesman for the chemistry laboratory. "Furthermore, we intend to develop our own product to guarantee security of availability. Practically all the potentially suitable coating metals (chrome, nickel-chrome alloy, stainless steel, aluminum) and all the plastics (polycarbonate, ABS, polypropylene, polymethyl methacrylate, polybutylene terephthalate) have been tested. But, for the moment, the war-horse is chrome and nickel-chrome on ABS."

"The possibility of depositing the alloys from a cathode of the same composition is one of the great advantages of sputtering," points out Remi Bienvenu, of the research and development laboratory. The coated parts include headlight bezels, wheel covers, and dome light rims, as well as parts for electric household appliances and for the perfume business.

The application which stirs the most hope is the headlight bezel for the future special export model Renault. Made of ABS, it is chromized on only part of its surface, a metal mask preventing deposition on the parts to be left uncoated. "With the traditional techniques, it would have been necessary to mold the piece in two parts, one black all through, the other chromized by electroplating. Or perhaps chromize the whole thing and then paint it, with all the adherence problems that would imply," explains Bienvenu, who stresses another advantage of cathode sputtering: "It preserves the mechanical properties." It is especially valuable for thin parts (less than 3 mm thick), which risk becoming warped in the hot-running electroplating baths or being embrittled by the chemical attack which precedes the electrodeposition of chromium.

The parts have a very beautiful appearance, at least equivalent to, if not better than, that obtained by electroplating. As for the cost of the treatment, it is two times less expensive according to a Seima estimate for a part that until now has been coated by electroplating. "And the ratio would certainly be even more favorable if the part in question had been specially redesigned for sputtering," asserts Bienvenu. Savings are achieved in the areas of consumption of chemical products, treatment of affluents (nonexistent with sputtering), tooling, and rejects. Also, the investment costs are one to two in favor of sputtering. And sputtering is even more profitable as the dimensions of the part become larger.

The comparison is not so favorable when sputtering is substituted for evaporation. Thus, according to Ernest Hirtz, of Hirtz Glassworks, "The coating cost for sputtered chrome is higher, but it is offset by decreases in the levels of rejects and maintenance." The Hirtz firm makes mirrors for rearview fixtures and has just acquired a Balzers chamber with a diameter of 1.5 m and a depth of 1 m, capable of treating 4 m^2 per 30 minute cycle. The chrome mirrors, whose reflectance is only 50 to 60 percent (compared to 94 percent for silvered mirrors), offer better safety in night driving and are in very strong demand in foreign countries (they are still not used in France). The present production of Hirtz Glassworks is around 100,000 to 150,000 pieces per month. The sputtered deposits really show their best results in tests imposed by manufacturers' specifications. They are more uniform and bond better than with evaporation. It is not necessary to employ a bonding varnish, or even a protective varnish (though that is indispensable for aluminum). Finally, the possibility of depositing alloys or composites opens up some new perspectives for development, such as interferential mirrors made by adding nitrides or oxides.

In decoration, the industrial breakthrough cathode sputtering is a matter of a few months, or even a few weeks. This is not the case in mechanical applications. There still, it seems that the relay from research and development to industry leaves something to be desired. In the laboratory, the know-how is already substantial. By virtue of the variety of alloys and composites which they make possible, the physical deposits are of interest in mechanical applications for several reasons, particularly when one seeks coatings that will be very hard, have a low coefficient of friction, or be self-lubricating, or perhaps have the ability to resist corrosion. LEMM and HEF have thus developed a coating with the ternary alloy iron-molybdenum-sulfur (deposited by reactive cathode sputtering, the sulfur being supplied by the gaseous atmosphere) whose coefficient of friction for dry surfaces is less than 0.04, or nearly half what could be expected with molybdenum disulfide (0.07).

A second direction of research is the very hard (2000 Vickers at least) titanium nitride coatings, which can be substituted for chrome and aluminum, and which compared to aluminum have the advantage of greater ductility. "Industrialization in these two directions will hopefully begin before the end of the year," remarks Jean Petit, technical director for the "friction" group at HEF. He does not specify which types of parts, but we know that some tests have been done on jack rods, ends of rocker arms, guide rails, pump facings, bearings, etc. The development of processes will depend not only on the development of suitable coatings, but also on equipment: specific cathode magnetron, machinery for treatment in bulk and in a continuous fashion, etc.

Deposition of very hard layers, such as titanium nitride, to improve the surface properties, is fine. But it is useless if the substrate is made of ordinary steel, incapable of supporting heavy loads, as is the case in certain applications.

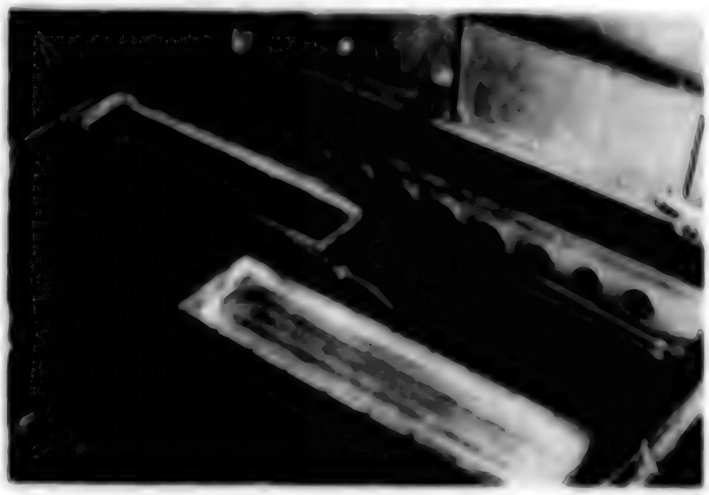
An Industrial Machine Between Now and the End of the Year

The foregoing statement about substrate strength is central to a new direction of research for the Laboratory of Metallurgical Engineering of Nancy. As Professor Michel Gantois explains, their new process "uses ion nitriding to reinforce the substrate with a diffusion layer, plus a physical deposit to form an antiwear coating." The two phases of the process take place in the same multipurpose chamber, at much lower vacuums than for sputtering (10^{-1} to 1 torr). It is thus not necessary to have a secondary vacuum. The rates of deposition, more rapid than in sputtering, are of the same order as for ion plating.

"At the moment, we are working in the area of antiwear and anticorrosion coatings," adds Gantois. The deposits studied are chrome, carbides of chromium and titanium, and nitrides of titanium. The substrates are chosen from the materials tolerating temperatures of at least 300°C. Ion nitriding improves the bonding of the layer. The pieces being treated (in the laboratory) are drill bits and cutting tools made of high-speed steel, and turbine elements. In this last case, for example, where the part made of 30 CD 12 nitriding steel operates under friction and must withstand substantial pressures, the nitriding layer is about 3/10 and the thickness of the TiN coating is about 5 to 6 microns. Other applications are possible in the treatment of hot-working tools for gearing. "It is hoped that an industrial machine will be constructed between now and the end of the year," says Gantois.

Seima: 20 m^2 Treated Per Hour

Viewed from the outside, the Seima cathode sputtering installation does not differ from an evaporation coating chamber. This is not surprising since it is a modified machine, in which the thermal sources have been replaced with two Balzers Planar-Magnetron cathodes with a total surface area of 8 dm^2. These targets consist of a plate of the metal (or alloy) to be deposited, serving as the cathode, positioned in the interior of a frame serving as the anode. The applied voltage is about 700 V. Beneath the cathode is a system of magnets producing a magnetic field assuming the form of a closed loop of semicircular cross section. The space where the ionization occurs is thus confined very close to the target, which increases the sputtering, i.e. the number of metal atoms emitted.



Two Planar-Magnetrons constitute
the source of metal to be deposited.

The parts, arranged on a rotating drum, successively arrive in front of the target (at a distance of 5-10 cm) and are coated at a rate of about 0.7 micron/minute. A coating of 500 angstroms is formed, and 20 m^2 can be treated per hour. The machine comprises three chambers: two locks for entry and exit and one working chamber. In the locks, the vacuum reaches 10^{-1} to 10^{-3} torr. It is produced by three primary vane pumps and a multistage Roots unit. In the treatment chamber, which is never opened to the atmosphere, the vacuum is brought to 10^{-4} in the evacuation phase after the introduction of the drum (by two vane pumps and two diffusion pumps), then it is maintained at 3×10^{-3} during the period of sweeping with argon. All phases of the treatment cycle (introduction of the drum into the entry lock, placing under vacuum, movement into the working chamber) are completely automated.

The varnishing before and after treatment (deposition of 15 to 20 microns of varnish) is still done manually.

When Ion Nitriding Is Combined With Sputtering

The process perfected at the Laboratory of Metallurgical Engineering of Nancy includes two phases of operation taking place in the same chamber:

The first is ion nitriding or carbonitriding. A gas mixture containing nitrogen, hydrogen, and methane is introduced into the chamber at a pressure of 10^{-1} to 1 torr. The parts to be treated are brought to a negative potential, and near their surface is produced a luminescent plasma containing the active ions, which diffuse into the metal and improve its hardness properties.

The second phase is the actual physical deposition of the metal, alloy, carbide, or nitride (of chromium or titanium for example), or perhaps even successive layers of different kinds. This phase of operation involves a target (or emitter) made of a material having the same constituents as the material one wishes to deposit, and this target is brought to a more negative potential than that of the substrate (or receptor). Around this target a luminous discharge is produced, resulting in heating of the target. This heating is very substantial (up to 1,300°C). The ejection of metal atoms is thus caused both by a thermal phenomenon and by the impact of the plasma ions, as in classical cathode sputtering. The deposition thus occurs at a faster rate. Also, the composition of the deposit will vary depending on this temperature, since it determines the rates of sublimation of the elements of the target. Thus, from an iron-chromium target containing 36 or 50 percent chromium, one can produce deposits containing 15 to 30 percent chromium, depending on the temperature of the target.

Also, the substrate is itself in a plasma: it therefore becomes the site of intense ion etching (as in ion plating techniques) which favors bonding of the layer. In the same manner as in reactive sputtering, nitrides or carbides may be deposited by manipulating the gaseous atmosphere introduced into the chamber.

The operation is controlled by the pressure of the gas and by the respective voltages of the emitter and receptor (which influence the temperatures).

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INDUSTRIAL TECHNOLOGY

INVERSION CASTING PROVIDES NONPOROUS ALUMINUM PARTS

Paris L'USINE NOUVELLE in French 12 Mar 81 pp 120-121

[Article by Dominique Benasteau]

[Text] "We guarantee the nonporosity of all our Invo-Cast parts. To date, we have not had a single complaint from our clients, not even those to whom, like Volvo, we deliver production runs of some 10,000 parts," says happily Christopher J. Butler, manager of the S. F. Butler Foundries group, of Brownhills at the northern edge of the Midlands industrial belt.

For Tony W. Orme, marketing manager, this technical feat represents a major asset that is being confirmed by the steady growth of the two foundries (aluminum and gray cast iron), on both the British and foreign markets. "From the marketing standpoint," he says, "Invo-Cast is a very attractive process, for it is clear that nonporous parts, having no need to be impregnated, are generating interest among potential users."

This reasoning, 2 years ago, justified the launching of a research and development program based on an idea advanced by the company's technical manager, Ben J. Richards. The market niche envisioned (parts for hydraulic and pneumatic mechanisms, but also all kinds of pressurized chambers, engine cylinder blocks) fit in well with the company's desire for diversification, a characteristic of the firm's policy. Tony Orme confirms, "We have always sought as wide a diversification in our orders as possible. Our rule has always been that no client must represent more than 20 percent of our business activity. We also try to avoid very large production runs."

For the casting of lightweight alloys, S. F. Butler used conventional processes: sand-casting or gravity-feed chill-casting, to the exclusion of all pressurized processes. Its gray cast iron foundry (Casthill Foundry), very close by, is the very epitome of simplicity: a single grade (the very universal "Ft") and a single box size.

Its sales sectors are highly diversified: from the machine tool to the data processing to the textile sectors, not to mention that of special types of automobile engines (the Land Rover line, diesels and turbos). As a result, the recession that is afflicting the various sectors has until now made no inroad into the Butler Foundries order books; on the contrary, Butler Foundries has continued augmenting its production year after year--a growth that has been made necessary by foreign market developments: the United States, above all, for gray iron castings, and Sweden, in particular, for aluminum alloy castings. The score of the S. F. Butler aluminum foundry, which employs 85 persons, is in fact quite remarkable: Of the 15,000 tons it produces annually, it exports 60 percent.

Now, as those who export are well aware, there is no better ambassador than quality and...yield. It is in these respects that Invo-Cast comes on strong: Before discussing his process, Ben Richards announces with justifiable pride that Invo-Cast yields "on average, 72 percent, but in favorable cases, 80-90 percent of the metal used, in parts!" When one realizes that a yield exceeding 50 percent using conventional processes becomes a feat of some magnitude... "Then, besides the economies in energy and material that such a yield represents, we also reduce the need for finishing operations: There is just one "appendix" to cut away, and the absence of rejects avoids the traditional problem of machining complex parts only to find eventually that they must be rejected because of porosity." In fact, the rough as-cast parts he displays have, in relation to their size, an astonishingly small feed head, but also a very sound "skin."

The secret of Invo-Cast: "We make parts, not feed heads and sprues as in the conventional processes," exclaims Ben Richards, as he explains how he came to his final results: "Until now, in the process of die casting, the metal pouring, owing to its speed of flow, caused vortexes which in turn produced faults. This problem was sometimes minimized by manually or mechanically inclining the mold some 30 to 45 degrees. This is the champagne-cup principle." There was the equally troublesome problem of filling "priority": The liquid metal first filled the die, then the sprue, which was put there to compensate the shrinkage during solidification of the piece. Owing, however, to the additional path traversed, its temperature was lower than that of the piece and porosity was frequently unavoidable. "In Invo-Cast, we do just the opposite," Ben Richards points out. "We invert the mold 180 degrees. We then inject the metal into a reservoir in its lower part, into a channel, and into what will become the sprue. Total volume: slightly greater than that of the piece."

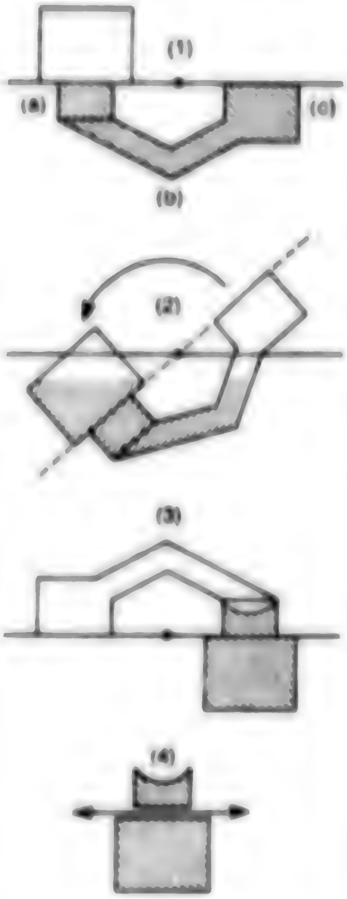
Process Not Limited to Aluminum Alloys

From that point on, everything hinges together. The chill is slowly (and automatically) again inverted . The important point is that the metal undergoes very little displacement and, above all, very little change of level. The excess, accurately calculated, finds no place in the mold and remains in the sprue, which thus finds itself holding the hottest metal! The effectiveness of the "feeding" of the piece during its solidification explains the elimination of all porosity. "I know that my sprue has done its job well," Ben Richards remarks. "Look at its knife-edged border!" Indeed, the effect of the internal "suction" is clearly visible on all sprues.

The result: Parts formerly cast by conventional pouring methods with a non-negligible rate of rejects, and now produced by the Invo-Cast process, no longer pose

(A)

Invocast : une pièce sans porosité en quatre mouvements



(B)

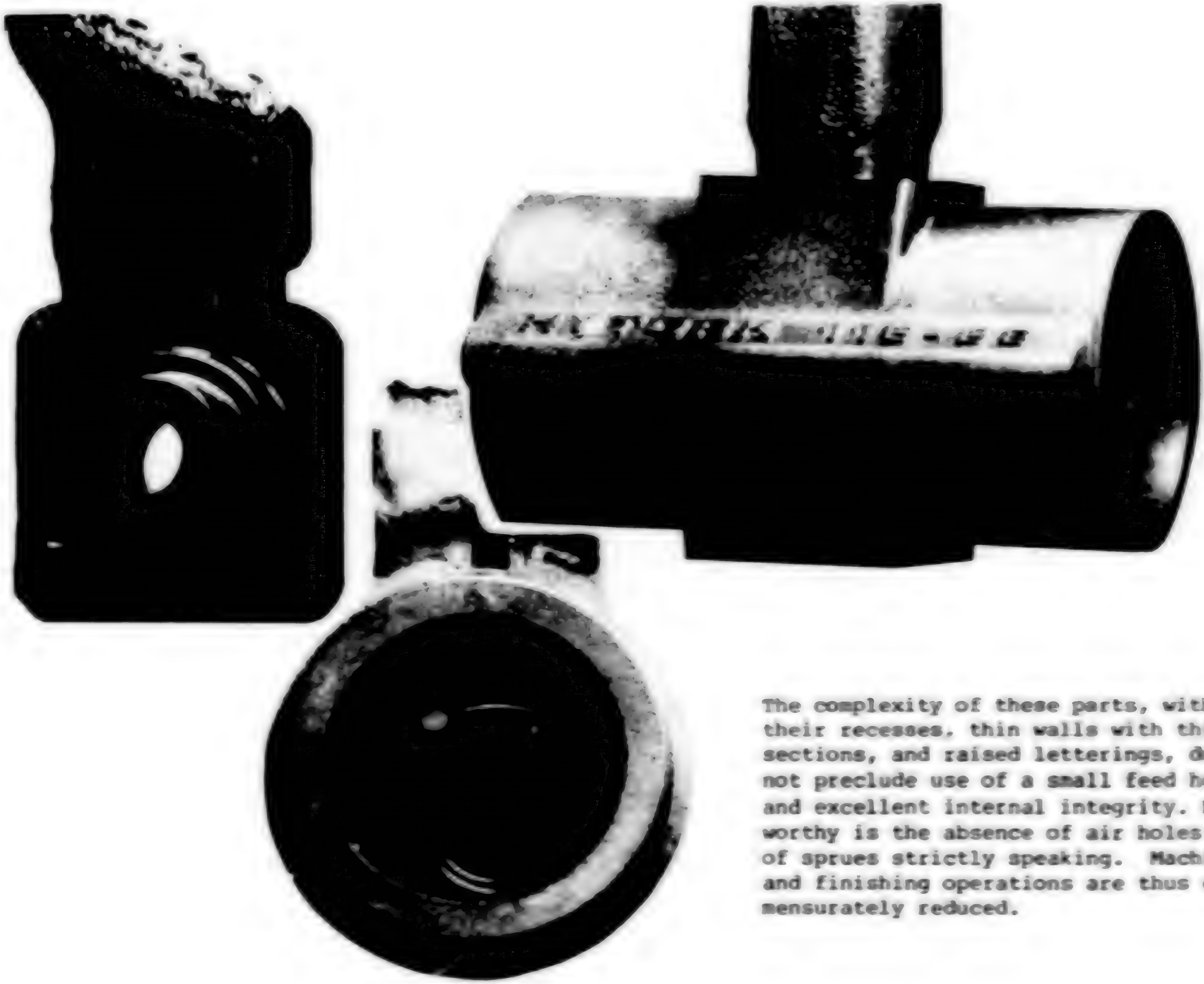
(1) Après remplissage de la masselotte (a) du jet de coulée (b) et du réservoir (c) le moule bascule lentement (2) jusqu'à complet renversement (3) Une seule opération est alors nécessaire pour séparer la pièce de sa masselotte (4)

Key:

A. Invo-Cast: A Nonporous Part in Four Movements.

B. (1) After the feed head (a), the pouring duct (b), and the reservoir (c) are filled, the mold tilts slowly (2), until it is completely inverted (3). A single operation is then required to separate the part from its sprue.

Shown here in the "pouring" position, this half-chill displays the mold for the part and, at its base, the feed head, the pouring duct and the reservoir.



The complexity of these parts, with their recesses, thin walls with thicker sections, and raised letterings, does not preclude use of a small feed head and excellent internal integrity. Noteworthy is the absence of air holes and of sprues strictly speaking. Machining and finishing operations are thus commensurately reduced.

the least problem. "Even for large production runs," Ben Richards explains, "the inverting operation is automatic, disengaging the results from the variations that are inherent in a manual operation." The Invo-Cast operator at S. F. Butler is often the least skilled workman in the foundry. The sole requisite is that he know how to lute and position cores.

The latter of these requirements is imperative, for certain pieces are genuine headaches: Some 10 cores of different sizes may have to be positioned in accordance with the three axes of the piece! The difficulties posed by other pieces, though perhaps less striking, are nonetheless as great: Raised lettering may appear at different points in vertical planes; thicker sections may have to be fed through very thin walls. The integrity of a greater thickness, running the entire length of a hollow cylinder, for example, may eventually be tested by drilling and threading it! No air holes will be found, of course: The inversion process in fact eliminates the need for this testing.

Certain ones of these pieces could have justified the use of low-pressure diecasting. But Invo-Cast, by virtue of its simplicity, is financially advantageous: No complex machinery; just a chill-inversion rack equipped with two burners to bring the mold up to proper temperature before the pouring. This is to ensure the establishment of a suitable temperature gradient. "To date, with this method, we have had no problems with any of the alloys tried. We have been able to produce all the parts ordered from us; the heaviest of these weighed 4.5 kilos."

And there is no reason why Invo-Cast must be limited to aluminum alloys, any more than gravity-feed chill casting need be: The principle can be used in sand casting and--why not?--even in combination with the V. Process to benefit from the advantages of both these innovations.

In any case, the mood is one of optimism at Butler Foundries: "We are on the verge of increasing Invo-Cast production," Tony Orme confided to us, pointing out the marked interest in the process being shown in England, but also on the continent and in the United States. And although his "business" is to fill up his order book and to exploit to best advantage the "guaranteed nonporous parts" niche, he envisions other outlets for Invo-Cast. And Christopher Butler confirms that: "We are prepared to enter into license agreements with other foundries. Our partners could produce parts based on the payment of royalties by the tonnage." For Invo-Cast is of course protected by patents. The seductive simplicity of the idea is but a seeming one: The know-how acquired in 2 years of research is essential.

9399
CSO: 3102/217

TRANSPORTATION

EXPERIMENTS WITH AUTOMATED MINIRAIL SYSTEM TO BE RUN

Paris LE FIGARO in French 23 Mar 81 p 24A

[Article by Maurice Cazaux: "Automated Minicars for a New 'Small Beltline'"]

> [Text] Is the future of urban transportation in the use of small remote-controlled vehicles traveling on rails, or in the improvement of the well-used bus and underground systems? Multiple new and original systems have appeared already 20 years ago, without succeeding in demonstrating clearly their advantages in the areas of safety and cost. The mayor of Paris believes it is well within his responsibilites to authorize a real-life experiment, using facilities of the French National Railroad. Within 5 years, it will be possible to determine whether the minicars can be used as early as 1990 on a section of the old railway beltline between the Porte de Meudon (Victor Station) and the Porte de Versailles. This morning, Jacquez Chirac will ask the Paris Municipal Council to approve this experimentation.

It is Matra Co. which developed small experimental vehicles in a transportation system designated ARAMIS, not after the shrewder and more mysterious of the three musketeers, but from the initials of the technical designation: Automatic Independent Module Train System.

There has already been much time available for prototype testing, since the first special ARAMIS track was built at Orly Airport 8 years ago to operate 3 small 6-seat vehicles on a request and with the financial support of the RATP [Independent Parisian Transport System]. These tire-mounted vehicles traveled as trains, but could also be independent and were hitched by an electronic coupling system. This system may be used to separate or couple the different vehicles of a train at will. A car can therefore be separated from a train to stop at a station without requiring the whole train to stop.

The conclusions of the experiment, summarized in 1976, were considered positive. Additional studies were therefore requested from Matra in order to arrive at a simplified version of ARAMIS resulting in lower investment costs and an omnibus operation allowing movements without load breaks. Stations are no longer set up parallel but vehicles must be able to switch between any lines in the network.

The new tire-mounted vehicle can seat 10 passengers. It is 1.62 m wide, 3.90 m long, and 2.15 m high. The electric motor allows it to climb 12 percent grades. Maximum speed is 50 km/h and theoretical capacity is 12,000 passengers per hour at peak load with a 30-second frequency.

The site chosen for experimentation and eventual approval is located in the "Citroen Cevennes" development area using tracks which were used to feed the Citroen plant from the Grenelle freight station. The test track will be a 1,200 m long loop with a 350 m long straight section. In the vicinity of the Victor Station (RER line C), a loop could be used to set up a connecting station. A roadbed will feed into it and a 600 m^2 maintenance and repair workshop will be built next to it.

In the event that the ARAMIS experiment is considered positive, in 1986, it will be relatively easy to build a small line to the Porte de Versailles as a first step, and continuing later on, using the facilities of the old "small beltline". It is not proposed to restart a noisy ordinary train service along the new buildings of this southern area of the French capital, but to operate a silent and discreet system.

However, Jacques Chirac is prudent. As he stated "The city of Paris is not making a commitment at this level. In spite of the obvious advantages that such a system seems to present because of the reduced space requirements, small height, and low noise level, some problems may arise because of new building construction along the "small beltline" tracks. It will be necessary to find solutions appropriate to each case: total enclosure, screen-walls, or embankment planted with bushes and trees. The Paris Municipal Council will obviously provide advice which will determine the final solution." Let's meet again in 1986.

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TRANSPORTATION

MERCEDES EXPERIMENTS WITH HYDROGEN, ALCOHOL, HYBRID ENGINES

Huizen AARDE & KOSMOS in Dutch Feb 81 pp 79-79

[Article by C.J. v. Lonkhuyzen: "Mercedes Experiments With Hydrogen Engine"]

> [Text] The Daimler-Benz factories in the FRG have been experimenting for a couple years already with engines which run on other fuels besides gasoline, diesel fuel or LPG.
>
> Alcohol and hydrogen are important energy carriers which are being researched there.
>
> Mercedes itself favors hydrogen, but it does not want to impose a political choice and this is why further research is being done in many areas.

The factories in the FRG are called Daimler-Benz; the car is the Mercedes Benz. This came about because when the Messrs Daimler and Benz -- or rather their representatives -- decided to proceed with a merger, Mr Daimler demanded that the car be named after his daughter: Mercedes.

At that time, Daimler had already done business in England. He discontinued this, but that factory does make Daimlers.

Two Advantages

As a fuel for cars, hydrogen has two advantages: it does not or only slightly polutes the atmosphere (this is especially important for city traffic) and the engine is the same as the well known gasoline engine. But there are problems. The simplest way to produce hydrogen is through the electrolysis of water. That is to say that with the aid of electricity, water is separated into hydrogen and oxygen. This would require a great deal of electricity, and as matters stand now a large scale shift to the use of hydrogen would also mean an agreement to build numerous (nuclear) power stations to produce all the necessary electricity. Thus, there is a dilemma.

Another problem, the storage of hydrogen in a car, has already been solved. Storage in a pressure tank (just as with LPG) has been rejected because of the danger involved. As a matter of fact, it would require a rather large tank because the energy density of hydrogen is much lower than that of gasoline. That difference is on the order of 1 to 10.

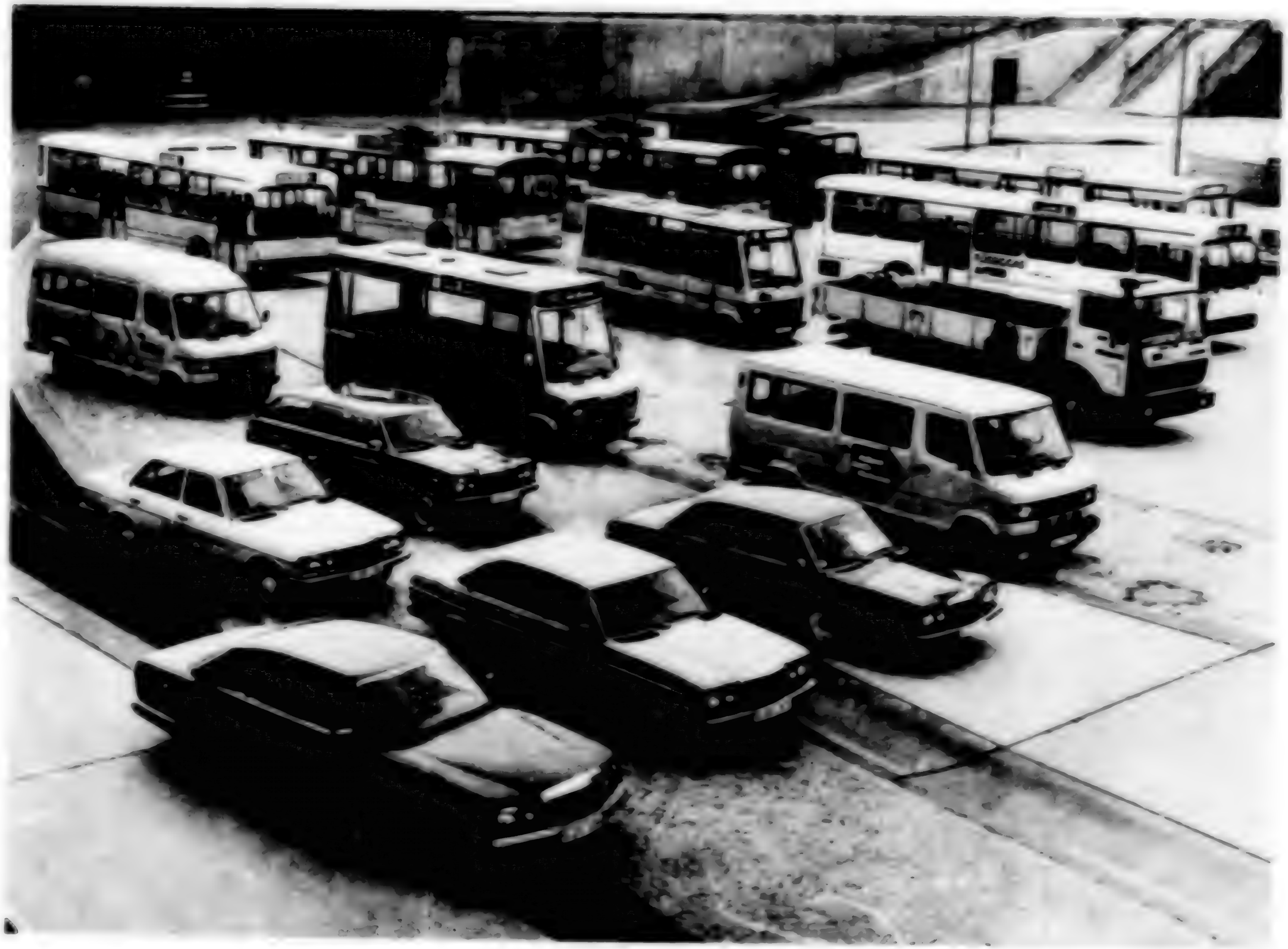

Fig. 1. Mercedes Benz has more than 100 cars involved in fuel experiments. There are 16 here. The front row runs on alcohol; the second row includes vehicles with hydrogen engines and a gyro-diesel engine. In the back row, there are buses with electrical and hybrid (combination of an electric engine and a gasoline engine) powered drives.

Fig. 2: The two cars which were equipped with a hydrogen engine by Mercedes. At the present time, the private car has been temporarily shelved again in order to try out improved techniques. Both cars are being used in Stuttgart.

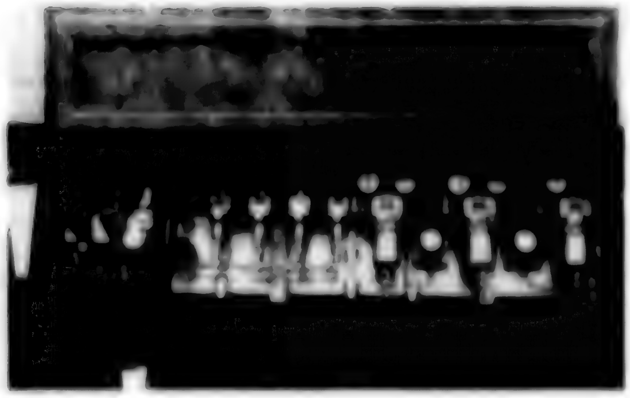

Fig. 3: The connection system between hydrogen tanks and engine. The construction is big and heavy and, as of now, is easier to install in a truck or bus than in a private car.

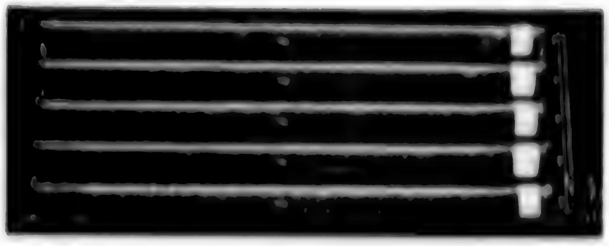

Fig. 4. A model (in plastic) of tubes with metal-hydrides for hydrogen storage. The tubes are surrounded by an external heat management system.

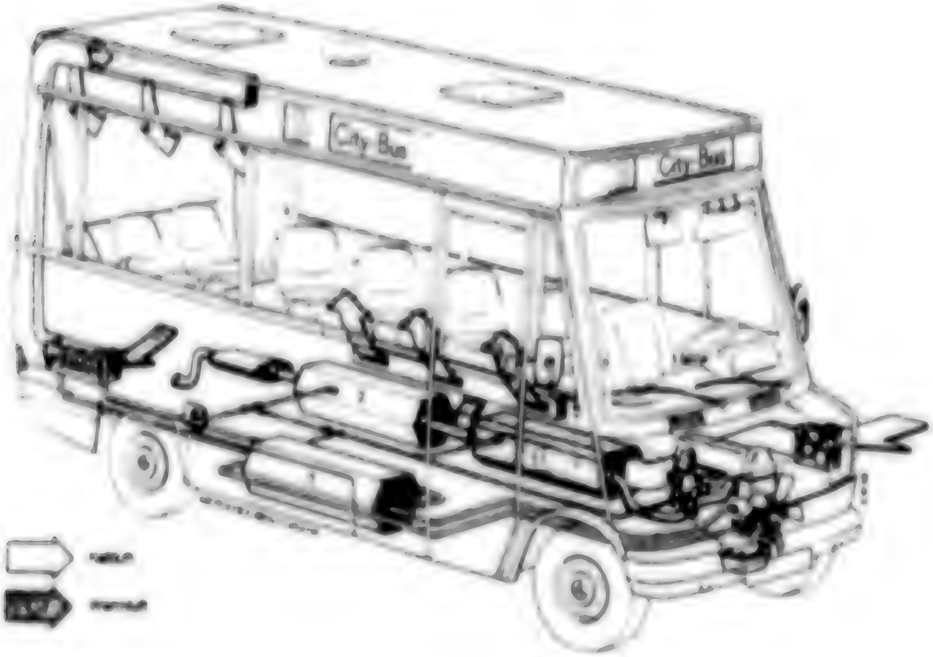

Fig. 5. Sketch of a hydrogen powered city bus. Three tanks with metal hydrides have been placed in this bus. Each of them functions at a different temperature.

Key:
1. cold air
2. hot air

Hydrogen Storage in Metals

They are now working with metal hydrides. Metal hydrides are compounds of metal combinations, such as titanium/iron or magnesium/nickel with hydrogen.

Even though this involves a chemical reaction, whereby heat is released (when the hydrogen fastens itself onto the metals) or absorbed (when the hydrogen is released again), the action is best understood by comparison with an activated charcoal tablet. In case of intestinal disorders, the tablet will completely disintegrate and the intestinal gasses will attach themselves to those minuscule particles of carbon. When hydrogen is stored with a bimetal, the metal also visibly disintegrates into a fine gray powder. The special feature is that when a cylinder -- like the ones used by welders -- is filled with a bimetal, it can hold twice as much hydrogen as if no bimetal were added and the gas were pressed into it under pressure. This absorption of hydrogen releases heat. The amount of heat depends on the choice of metals. Thus, if hydrogen is needed, then heat will have to be supplied and this is why, just like a diesel engine, a hydrogen engine will work only after a short warming up period.

The combustion of hydrogen produces water. Combustion is nothing but the household word for oxidation and that means to combine with oxygen. And to combine hydrogen with oxygen produces H_2O, water.

Such a hydride storage is a "weighty" matter. In order to have as much energy in the tank as in a gasoline tank with approximately 15 liters, one must carry along 300 kilograms of metal hydride.

Hydrogen from Natural Gas

It has already been said (and the warning comes from Daimler-Benz) that a great deal of electricity is required to turn water into hydrogen. But it can also be done differently. Both natural gas and city gas also contain a great deal of hydrogen: 60 percent.

Hence, one could imagine a situation whereby a person would have a container with a large amount of an appropriate bimetal at home. If such a gas were to be led through this container, then hydrogen could be yielded from that gas. This would mean [illegible] then. The released heat could be used for the household.

The energy yield of the gas would be greatly increased this way, because it is used both for heating and driving. But it would require a rather far-reaching social reorganization to provide the homes of car owners with such a gas filtering system and heat pump.

And yet, the people at Daimler-Benz see it as a possibility. One would then have to assume that hydrogen would be used for city traffic: a hydride tank holds fuel for approximately 3 hours. Gasoline or diesel fuel or methanol (alcohol) remain the fuels for long distance traffic.

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TRANSPORTATION

NEW AIRBUS AIRCRAFT TO HAVE LATEST AIR NAVIGATION EQUIPMENT

Paris LE MONDE in French 15 Apr 81 p 13

[Article by X. W.: "Cathode Ray Tubes Aboard the New Airbus Aircraft"]

[Text] Aboard modern aircraft the pilot is more and more tending to become the servant of an entire on-board ensemble of apparatus of growing complexity, born of automation and data processing.

Civil aircraft are thus equipped with veritable on-board computers responsible today, on the basis of data provided by a multiplicity of pick-ups and sensors, for a number of tasks which are still limited but already important since they notably include automatic piloting. The future series of the Airbus A-310 and A-300/600 will be equipped with a new generation of on-board instruments, manufactured by Thomson-CSF [Thomson-General Radio Company] in collaboration with the German company VDO Luftfahrtgerate Werk [VDO Air Navigation Instrument Works], which fully illustrate this development. The Boeing 757 and 767 will be fitted with the same type of equipment.

The instrument panel of the future Airbus aircraft, like that of the future Boeing aircraft, will in fact display a complete set of innovations visible at first glance: conventional air navigation instruments will have disappeared, making way for television screens. Cathode screens with high color definition (masked tubes) functioning as "terminals" for the on-board computers will thus replace two basic electromagnetic instruments which, for any pilot, are the artificial horizon and compass dial.

In the case of the artificial horizon the change appears to be still relatively limited: the "primary flight display" which takes its place resembles it in many respects. The possibilities of the television picture, which enables the form and color of the symbols employed to be greatly varied, permit the addition of supplementary information: for example, a scale of speeds--with display of the upper and lower safety limits--and altitude.

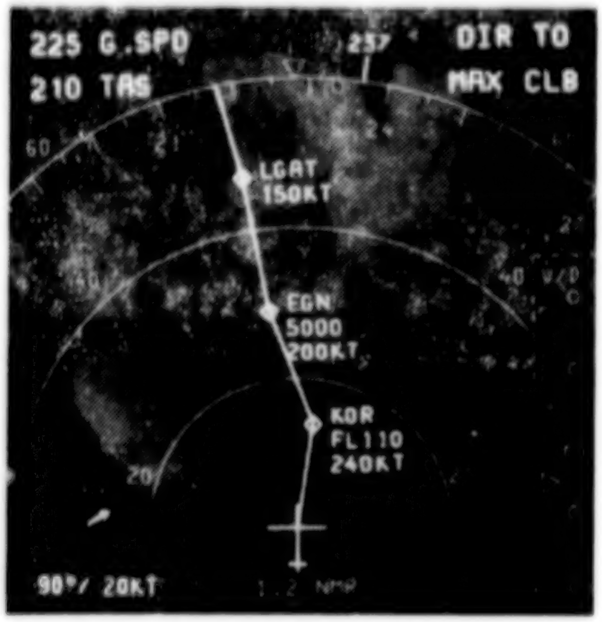
The most spectacular change involves the compass card: the new "navigation display" can certainly serve to present this traditional compass card. Above all, it can display a veritable navigation map: on the photo below one may distinguish the aircraft's silhouette at the bottom and (broken white line) the path it is going to have to follow, from radio beacon to radio beacon, to the destination airport (here it is Athens). At the first beacon (KOR) the pilot thus knows that he should be at an altitude of 11,000 feet (flight level 110) and moving at 240 knots; and 5,000 feet and 200 knots at the second beacon. At the top an arc of a circle makes it possible to see the magnetic heading and the route taken (237 here). Still other information may be derived: for example, at top left, the ground speed (225 knots here) and the air speed (210 knots); or, at bottom left, the direction (90°) and velocity (20 knots) of the wind, represented by a small arrow.

Last, gray areas appear here (they are in fact, like all the rest, in color): the computer actually superposes the image of the aircraft's meteorological radar upon the navigation map properly speaking. These gray areas represent the principal cloud formations.

To these four screens (two for each pilot) which replace the conventional instruments there are added two others placed between the pilot and copilot; they display the data from a central electronic alarm system: for example, "pressure drop in the yellow hydraulic circuit" and indications to supplement these data. This pressure drop requires the pilot to close a valve, which the screen will ask him to do. The alarm system, once that operation has been accomplished, will continue to provide the crew with pertinent data.

The matter is still one of only aid to decision making, emphasized by the fact that upon the second screen there will appear a synoptic diagram of the system posing a problem. It must be noted that these new screens, providing the captain and his copilot with the maximum of information about the operation--and possible problems--of the aircraft, are going entirely in the direction of the "two-man crew" which the airlines are seeking to institute against the wishes of the unions of flight personnel.

But the systems well demonstrate that the "automatic airplane" today is no longer a totally utopian dream: a computer which displays "this valve must be closed and that pump disconnected from the circuit" will one day easily be able to effect that decision all by itself.



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TRANSPORTATION

BMW "PARTIAL LOAD" ENGINE SAVES 25 PERCENT FUEL

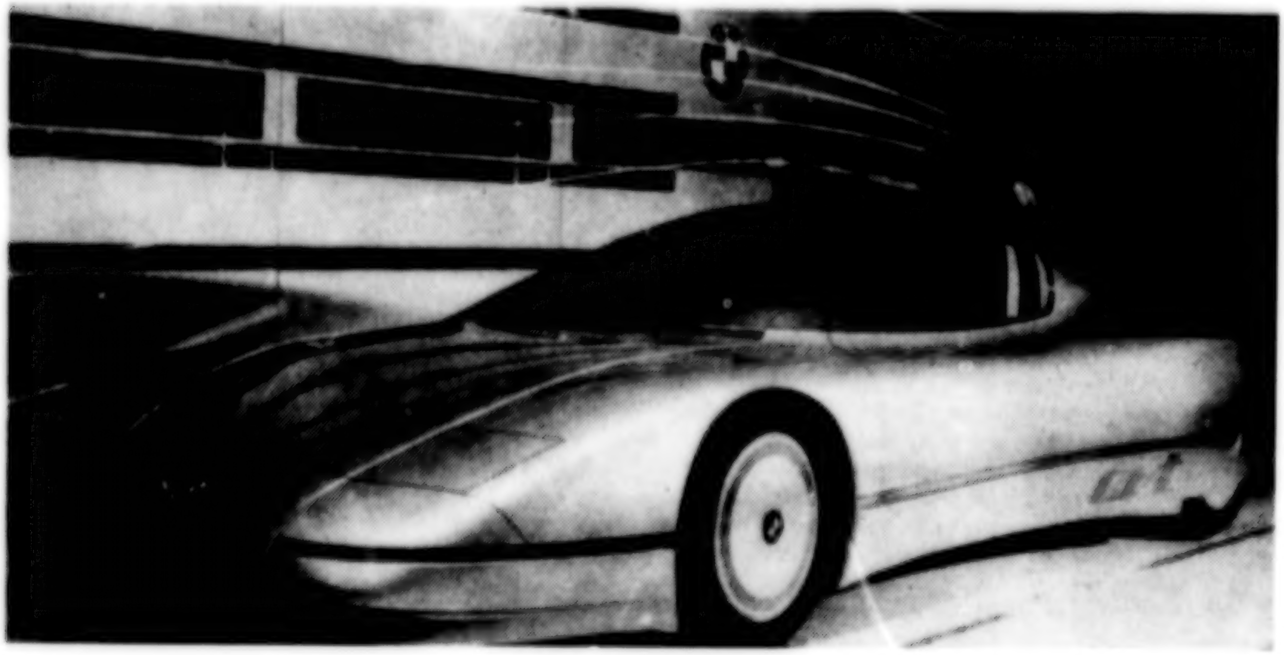
Paris LE MATIN in French 2 Apr 81 p 21

[Article by Philippe Hazan: "BMW: 'Partial Load' Engine Soon To Be in Production; It Makes Possible Fuel Savings of Up to 25 Percent by Using Three out of Six Cylinders at Low Speeds"]

> [Text] The "omnidirectional" research carried out by BMW [Bayrische Motorwerke; Bavarian Motor Works] in energy saving since 1974 are in the process of bearing fruit. The Bavarian firm has in fact just shown a 323i equipped with the remarkable "partial load" engine whose development stage seems more advanced than the people at Munich would like to have it believed.... This engine--operating alternatively on three out of six cylinders--may be assembled upon some "series 3" starting in the beginning of 1982.

At present a half-dozen manufacturers are actively engaged in work on the partial load engine whose principle--in its broad outlines--is extremely simple. A car intended for normal road use does not always need full power, it does not need all its cylinders. On the other hand, even in town, there must be enough horsepower available to pull out of a difficult situation. The principle thus consists of arranging that a certain number of cylinders remain inoperative (by being automatically disconnected) when the driver is moving either at low speed or in stop and go traffic. At this time, in fact, the principle is that the vehicle is rolling, the notion of power positively not entering into consideration. Certain manufacturers--including Mercedes-Benz and Porsche--have completely or partially resolved this hypothetical case. It is specifically the response time in switching, for example, from three to six cylinders that some motorists come up against. Cutting the power is a relatively easy matter. But regaining power as rapidly as possible, in contrast, is much more complicated because the time factor is a matter of tenths of a second. It is precisely in this area that BMW has just made a significant advance with its TZA system of "disconnecting cylinders under partial load." The BMW 323i shown at the last BMW technical congress is an example of it. At minimal loads (which it is possible to vary by means of electronic accelerator control) only three cylinders are put into operation.

Ignition and fuel supply of the other three are automatically cut off. The vehicle operates in this way up to 120 km per hour. Any abrupt pressure upon the accelerator must simply be avoided above 45 km per hour. On the other hand if one pushes the pedal to the floor all power is recovered and use of six cylinders is regained. At present there are 20 BMW 323i series vehicles with TZA motors in operation. The fuel saving amounts to 25 percent according to the European cycle in comparison with conventional 2,300-cubic centimeter six-cylinder engines. In the case of mixed town and highway driving the saving is decreased by 20 percent. Entering the final phase of development, the process may be incorporated in a small production run in bottom of the line vehicles ranging from the 320 (2 liters) to the 323i (2.3 liters with fuel injection) at the end of 1981. At the congress BMW also presented the results of its work on saving weight. A weight reduction of 10 percent provides a fuel saving of 3 percent. Thus we have seen openwork door handles in which 30 grams have been saved and window mechanisms of aluminum, not steel, also in openwork (saving: 220 grams). In the area of aerodynamics we were able to see carefully made full size prototypes in the course of tests in the wind tunnel "house", a replica of Saint-Cyr-l'Ecole. The German firm is resolved to reduce the coefficient of air penetration (Cx) by transforming it--for the Series 7, for example--from 0.45 to 0.36 for 1990. An ambitious undertaking as the German technicians like, they who work without constraint in a country where the automobile is still King....



[Caption] The model destined for tests in a wind tunnel

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